

ART 34 AMDT

PCT/IL03/00727

17

## CLAIMS:

1. A fluid metering system comprising a fluid supply line and a fluid-flow meter for measuring fluid flow therethrough, said flow meter having a minimum measuring flow threshold; the system further comprising a valve having an inlet port and an outlet port; said valve being shiftable between an open position at-to measure consumed flow rates, which are above theits minimum measurable flow threshold, and a pressure-pulsating position, -depending on pressure differential over its ports, in which said valve pressure pulsating position is adapted altering between a closed position essentially prohibiting either to periodically prohibit fluid flow to the fluid supply line therethrough at-until a pressure differential over the valve ports is being built-up due to consumed flow rates, which are below the measurable flow threshold flow rates below the minimum measuring flow threshold, and an open position or to admitting fluid flow into the supply linesupply line until the pressure differential diminishes below a predetermined threshold, wherein said flow meter is adapted to simultaneously measure the admitted fluid flow at-a measurable flow rate above the minimum measuring flow threshold.
2. The fluid metering system according to Claim 1, wherein the valve is a normally closed pressure controlled valve.
3. The fluid metering system according to Claim 1, wherein the valve is fitted adjacent before or after the fluid-flow meter.
4. The fluid metering system according to Claim 1, wherein the valve is integrated with the fluid-flow meter.
5. The fluid ~~flow~~-metering system according to Claim 1, wherein portions of the supply line and devices fitted thereon, downstream of said pressure controlled valve, act as a fluid accumulator.
6. The fluid metering system according to Claim 1, wherein the system is a liquid supply network.
7. The fluid metering system according to Claim 6, wherein the system is a municipal water supply network.
8. ~~A-The fluid metering system according to claim 1, wherein comprising a meter for measuring fluid flow and having a minimum measuring flow threshold; the system further comprising said valve is~~ a flow responsive valve having an open position admitting fluid

Best Available Copy

ART 31/2007

PCT/IL03/00727

18

flow only at a flow rate above the minimum measuring flow threshold, and a closed position substantially restricting fluid flow at flow rates below the measuring threshold.

9. ~~A~~The fluid metering system comprising according to claim 8, wherein a fluid supply line and a meter for measuring fluid flow therethrough, said meter having a minimum measuring flow threshold; the system further comprising a said flow responsive valve is adapted to imparting the system with a flow pattern having a pulsating character so as to substantially prohibit flow at a flow rate below the minimum measuring threshold, and resume flow of only measurable quantities of fluid.

10. The fluid metering system according to Claim 9, wherein the flow responsive valve is shiftable between an open position whenever pressure differential over an inlet port and an outlet port thereof exceeds a minimum pressure threshold, to thereby admit fluid flow at a flow rate above the minimum measuring flow threshold, and a closed position substantially prohibiting fluid flow therethrough.

11. ~~The method-fluid metering system~~ according to claim 1, wherein the valve is a one way valve, adapted to preventing flow in an upstream direction.

12. A method for metering fluid flow through a fluid supply line, said method comprising: providing a flow meter for measuring fluid flow through the supply line, said flow meter having a minimum measuring flow threshold; providing a valve having an inlet port and an outlet port;

20 measuring consumed flow rates, which are above the minimum measurable flow threshold, or

imparting the supply line with a flow pattern having a pulsating character in which said valve is adapted either to periodically prohibit fluid flow to the fluid supply line until a pressure differential over the valve ports is being built due to consumed flow rates, which are below the measurable flow threshold or to admit fluid flow into the supply line until the pressure differential diminishes below a predetermined threshold;

25 measuring the fluid flow simultaneously with admitting thereof.

13. The method for metering fluid flow according to Claim 12, wherein average fluid flow through the system ~~remains constant over time, wherein the average fluid flow through the supply line is kept remains constant over time so long as flow rate fluctuations in the supply line imparted by the system according to the present invention are not~~ acknowledgeable.

Best Available Copy

ART 34 AMDT

PCT/IL03/00727

19

14. The method for metering fluid flow according to Claim 12, ~~wherein the flow responsive valve is comprising fitting said valve~~ adjacent to or integrally with the flow meter.
15. The method for metering fluid flow according to Claim 12, wherein portions of the supply line and devices fitted thereon, downstream of said ~~pressure controlled valve~~, act as a fluid accumulator.
16. A valve comprising an inlet port connectable to an upstream side of a fluid supply line, and an outlet port connectable to a downstream side of the fluid supply line; said valve further comprising a housing with a control chamber extending between the inlet port and  
 10 the outlet port and a sealing member disposed within said control chamber; said sealing member having an inlet sealing surface having a sealing surface area and a control portion having a control surface area; and a bleed aperture determining a minimal flow threshold through the control chamber; wherein the sealing member displaces-is displaceable  
 15 between an open position and a closed position depending on a pressure differential over the sealing member, said pressure differential is being built when consumed flow rates in the fluid supply line are below the measurable flow threshold.
17. The valve according to Claim 16, being a normally closed flow responsive valve and wherein the sealing member is biased into sealing engagement ~~of-with~~ the inlet port.
18. The valve according to Claim 17, wherein the sealing member is spring biased into  
 20 sealing engagement of-with the inlet port.
19. The valve according to Claim 17, wherein the sealing member is magnetically biased into sealing engagement ~~of-with~~ the inlet port.
20. The valve according to Claim 19 wherein the sealing member comprises a ferromagnetic member and ~~a-the housing of the device is fitted with a fixed magnetic~~  
 25 biasing member, to thereby bias the sealing member into sealing engagement of-with the inlet port.
21. The valve according to Claim 20, wherein the sealing member is coated with a resilient material.
22. The valve according to Claim 16, said valve is adapted for to imparting a-the fluid  
 30 supply line with a pulsating fluid flow pattern, corresponding to extending between a-the sealed-closed position and-a-or the open position of the sealing member, and wherein the valve is adapted to keep an average fluid flow through the supply line remains-constant

Best Available Copy

ART 31 AMDT

PCT/IL03/00727

20

over time so long as flow rate fluctuations imparted by the system according to the present invention in the supply line are not acknowledgeable.

23. The valve according to Claim 16, wherein the sealing surface area is ~~smaller~~ less than the control surface area.

5 24. The valve according to Claim 16, wherein the bleed aperture is an interstice between a ~~the housing of the device and~~ the control portion.

25. The valve according to Claim 17, wherein ~~a flow restriction~~ the sealing member and the control chamber are configured and dimensioned ~~is formed at the open position, so as to increase flow speed at a downstream side of the sealing member when it is in the open position as to increase flow speed at a downstream side of the sealing member,~~ to thereby give rise to a force in a direction opposed to a sealing force acting on the sealing member.

10 26. The valve according to claim 24, wherein the sealing surface area is a cylindrical bore ~~of extending through the housing of the valve;~~ the bore is formed with an expansion expanded portion and the sealing member is formed with a tapering portion corresponding with the ~~expansion~~ expanded portion, ~~thereby giving rise to head loss when the sealing member displaces into an open position, so as to increase opening force of valve.~~

15 27. The valve according to claim 16 being a one way valve, preventing flow in an upstream direction.

20 28. A flow responsive valve for a flow metering system comprising a supply line and a fluid meter having a minimum measuring flow threshold; said flow responsive valve having an inlet port and an outlet port and being shiftable between an open position to measure consumed flow rates, which are above the minimum measurable flow threshold, and a pulsating position, in which the valve is adapted either to periodically prohibit fluid flow to the fluid supply line until a pressure differential over the valve ports is being built  
 25 due to consumed flow rates, which are below the measurable flow threshold or to admit fluid flow into the supply line until the pressure differential diminishes below a predetermined threshold ~~said valve being shiftable between an open position at flow rates above the minimum measuring flow threshold, and a pressure pulsating position depending on pressure differential over its ports, said pressure pulsating position altering between a~~  
 30 ~~closed position essentially prohibiting fluid flow therethrough at flow rates below the minimum measuring flow threshold, and an open position admitting fluid flow into the supply line at a measurable flow rate above the minimum measuring flow threshold.~~

Best Available Copy

ART 34 AMDT

PCT/IL03/00727

21

29. A flow responsive valve according to claim 28, ~~for a flow metering system comprising a fluid meter having a minimum measuring flow threshold; said valve being shiftable between an open position at flow rates above the minimum measuring flow threshold, and a pressure pulsating position depending on pressure differential over an inlet port and an outlet port of the valve; said pressure pulsating position~~ which is adapted to altering between a closed position-state essentially prohibiting fluid flow therethrough at flow rates below the minimum measuring flow threshold, and an open position-state admitting fluid flow into the supply line at a measurable flow rate above the minimum measuring flow threshold; said valve further comprising a suspension mechanism for delaying fluid flow through the valve at the open state ~~of the pulsating position~~.
30. A flow responsive valve according to claim 29, wherein the suspension mechanism comprises a pressure responsive sealing assembly comprising an axially displaceable plunger and a stationary cup member with a damping assembly received therebetween to dampen axial displacement of the plunger.
31. A flow responsive valve according to claim 30, wherein the damping assembly is received within a confined space and is provided with a sealing sleeve applied for restricting liquid flow into the confined space.
32. A flow responsive valve according to claim 30, wherein the pressure responsive sealing assembly further comprises a diaphragm seal retained within the housing and being deformable only in a downstream direction.
33. A flow responsive valve according to claim 30, wherein the plunger is provided with a circumferential peripheral edge of the plunger is pointed and is adapted to displace against a cylindrical surface of the housing to thereby scrape it from dirt.
34. A flow responsive valve according to claim 30, wherein facing edges of the plunger and the stationary cup member have complimentary mating shapes.
35. A flow responsive valve according to claim 31, wherein the damping assembly is comprises a biasing spring bearing At at one end against the stationary cup member and at an opposed end against the plunger.
36. A flow responsive valve according to claim 32, wherein at a closed position-state thereof the plunger is retracted from the cup member and sealingly bears against the diaphragm seal, where liquid does not flow through the valve, and where the inlet pressure  $P_i$  is equal to the outlet pressure  $P_o$ .

Best Available Copy

ART 34 AMDT

PCT/IL03/00727

22

37. A flow responsive valve according to claim 32, wherein upon pressure differential built-up over the valve ports, the plunger is extractables downstream, followed by deformation of the diaphragm seal, to thereby close the valve.

38. A flow responsive valve according to claim 32, wherein disengagement of the diaphragm seal from the plunger results in further displacement of the plunger towards the stationary cup member, to thereby increase liquid flow through the valve, when it is in theat a pulsating regime position and at a measurable flow rate.

39. A flow responsive valve according to claim 32, wherein at ~~an~~ the open position-state of the valve the plunger ~~displaces-is displaceable into-until~~ engagement with the stationary cup member thus facilitating liquid flow at a considerable flow rate.

40. A flow responsive valve according to claim 40, wherein at the fully open position ~~state~~ of the valve the plunger mates with the stationary cup member to form an egg-like shape.

41. A fluid metering system comprising a fluid supply line and a meter for measuring fluid flow therethrough, said meter comprising a fluid flow responsive impeller and having a minimum measuring flow threshold; the system further comprising a flow responsive valve having an inlet port and an outlet port; said valve being shiftable between an open position to measure consumed flow rates, which are above the minimum measurable flow threshold, and a pulsating position, in which said valve is adapted either to periodically prohibit fluid flow to the fluid supply line until a pressure differential over the valve ports is being built-up due to consumed flow rates; which are below the measurable flow threshold or to admit fluid flow into the supply line until the pressure differential diminishes below a predetermined threshold, imparting the system with a flow pattern having a pulsating character so as to substantially prohibit flow at a flow rate below the minimum measuring threshold, and resume flow of only measurable quantities of fluid;

said valve further comprising a suspension mechanism for delaying fluid flow through the valve at the open state of the pulsating position when it admits the fluid flow..

Best Available Copy